



# ARAT BULLETIN



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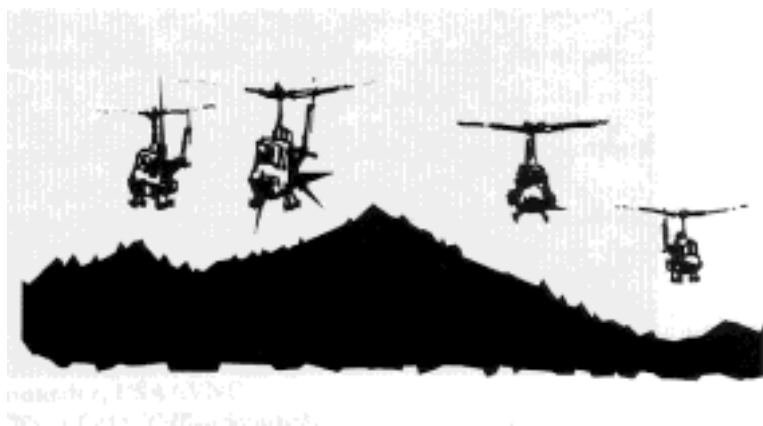
Volume 1, Issue 4

January 1995

## TRAINING: BREAKING DOWN THE WALLS TO ACHIEVE SUCCESSFUL REPROGRAMMING!

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# ASE/EWO:

## The Aviation Commander's Combat Force Multiplier

As the dust settled from Operation DESERT STORM, many questions were answered concerning the readiness and performance of U.S. combat equipment. Despite the swift Iraqi defeat, Army leaders realized that improvements must be made in the area of Electronic Warfare (EW) training. It was recognized that there was a shortfall of fundamental knowledge and operating information concerning Aircraft Survivability Equipment (ASE). Furthermore, Tactics, Techniques, and Procedures (TTP) needed to be developed to enhance aircraft survivability against enemy EW equipment.

Many recommendations followed DESERT STORM/SHIELD on how to solve the information dilemma. However, the issue was and remains more complex than just how to operate existing ASK and employ tactics. It has become apparent to Army leadership that a dedicated ASK EW Officer (EWO) position must be created within aviation units based on the proliferation of technology in Electronic Countermeasures (ECM) and a paradigm shift on the approach to battlefield digitization.

On 20 November 1991, the U.S. Army Aviation Center (USAAVNC) Commanding General issued a letter directing each Aviation Brigade Commander to appoint an ASE/EWO. Since then, the Army has advanced considerably in the implementation of a formal ASE/EWO structure. One crucial part of this was the inauguration of the ASE/EWO course on 1 October 1994 at Fort Rucker, AL. This course offers the ASE/EWO a Warrant Officer Additional Skill Identifier of H3. Currently, nearly 300 Army aviators have been graduated from the ASE/EWO mobile and resident courses.

The ASE/EWO is trained to use intelligence data to produce meaningful risk assessment for aircraft. They are trained on all Army ASK systems. Their training allows them to optimize the assigned aircraft's chance of survival by selecting ASK configuration settings based on the threat, the aircraft and the mission. Some other responsibilities include evaluating ASK operational readiness, monitoring inspection and maintenance of Army ASK

systems, developing and employing TTPs for their unit, and coordinating the reprogramming of ASK systems among others.

The ASE/EWO is also trained to identify the factors causing high risk and to identify risk reduction techniques in order to increase aircraft survivability. They are the primary threat and countermeasures (CM) trainer at the company level. They are feeders to the Tactical Operations officer, as well as mission planning team leaders.

Upon receipt of the Intelligence Preparation of the Battlefield (IPB) and the assigned unit mission, they begin to prioritize the threats and apply optimum CM to those threats. The ASE/EWO then identifies the cause of the risk and recommends risk reduction techniques that will allow mission accomplishment. The prioritized threat list is passed through intelligence channels to pinpoint critical elements of information. (For example, if the unit has no ASK protection from Threat X, it is important to direct intelligence efforts to locating and passing Threat X data to the aviation unit.) The ASE/EWO is also trained to perform terrain planning to minimize exposure to known or suspected threat locations. As the Aviation Mission Planning System (AMPS) is deployed, the ASE/EWO will possess the knowledge to automate the manual mission planning currently performed. AMPS can be reprogrammed as the mission changes in order to tailor specific packages.

The ASE/EWO training is mandatory for Warrant Officers serving as Tactical Operations Officers in aviation units. The ASE/EWO is proving to be a valuable asset to the Aviation commander. The ASE/EWOs being trained today are pioneers blazing a new trail for Army Aviation battles of the future. For further information concerning ASE/EWO duties and the resident course at Fort Rucker, contact the USAAVNC Army Reprogramming Analysis Team Support Cell (ARAT-SC) (see also chart on inside cover page). POCs are Mr. Ed Bavaro/Mr. Mike McMillon, DSN: 558-9300.

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EWOs support Army Aviation assets such as the Apache helicopter.

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## EO/IR, FIBER OPTICS & LASER TRAINING

Fort Monmouth hosted a training course recently, from 16 - 18 Nov 94, called Electro-Optics/Infrared (EO/IR), Fiber Optics and Lasers. The course, sponsored by the Army (Target Sensing Systems) Rapid Reprogramming Project Office (ARAT-PO), was taught by Mr. Mark Branham from George Washington University. Some of the information presented has practical applications for the reprogramming of Target Sensing Systems (TSS). Mr. Branham provided an introduction which covered basic physics to include properties of light, light transmission, modulation techniques, multiplexing and fundamentals of digital communications. He then discussed in-depth the areas of (EO/IR), Fiber Optics, Lasers, and applications.



**Mr. Mark Branham discusses laser applications for Target Sensing Systems.**

Subjects covered under EO/IR included optical switching, integrated optics, low light level and night vision devices, passive systems, thermal imaging and optical information processing. The block of instruction on Fiber Optics discussed such topics as fiber optic transmission, video and data transmission, coupling and splicing techniques, and system design using fiber optics. The section on lasers covered types of lasers, semiconductor and Eximer lasers, beam deflection and manipulating, laser modulation methods, laser scanning techniques, and more. The applications section discussed topics such as digital data systems, analog information systems, security systems and military and aerospace systems.

The intent of this class was to provide participants with information which could be used, as applicable, in software development/support for their particular programs. Some technology concerning lasers is already being used as part of the AN/AVR-2 Laser Detecting Set, which is currently found on some U.S. Army aviation platforms. The ARAT-PO periodically sponsors or assists in sponsoring training which can benefit the Army reprogramming community. More information on this course can be obtained by contacting the ARAT-PO. POC's are Mr. Mike Hseuh (Technical), DSN: 992-1373/Mr. Verne Pedro (Training), DSN: 992-1337/3512.

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## JOINT COORDINATION OF EW REPROGRAMMING

*"In war, there is never any chance  
for a second mistake."*

*Lamchus, 465-414 B.C*

The purpose of Electronic Warfare (EW) reprogramming is to maintain or enhance the effectiveness of EW/Target Sensing System (TSS) equipment maintained by field and fleet units. EW reprogramming includes changes to self-defense systems, offensive weapons systems and intelligence collection systems. The reprogramming of EW/TSS equipment is the responsibility of each Service through their respective EW reprogramming support programs.

Joint Coordination of EW Reprogramming (JCEWR) is the integration of intelligence with the service EW/TSS reprogramming efforts, to support the Theater Combatant Commander/Joint Task Force (JTF) Commander's Command and Control Warfare (C2W) objectives. It is critical since

**(continued on next page)**

## Joint Coordination (continued)

reprogramming in itself affects, or is affected by, each division of joint EW operations such as Electronic Attack (EA), Electronic Protection (EP), and Electronic Support (ES). The establishment and execution of JCEWR procedures is the responsibility of the unified, component and joint force commanders.

The EW reprogramming process is divided into four phases. These are (1) Determine the Threat, (2) Determine the Response, (3) Create the Change, and (4) Implement the Change.

In the first phase, intelligence analysts determine the threat and perform threat change validation. The Joint Procedures for Intelligence Support to EW Reprogramming set forth procedures, guidelines and criteria governing joint intelligence activities supporting EW reprogramming. During peacetime or times of increasing tension, the responsibility for threat change validation is a function of the appropriate S&TI center: National Air Intelligence Center (NAIC), Missile and Space Intelligence Center (MSIC), Office of Naval Intelligence (ONI), or National Ground Intelligence Center (NGIC). During wartime, this function transfers to the unified command's Intermediate Processing Center (IPC): Atlantic Intelligence Command (AIC), Joint Analysis Center (JAC) RAF Molesworth, and Joint Intelligence Center Pacific (JICPAC).

During the second phase, validated threat change information is used to assess its impact upon friendly EW/TSS equipment. A decision is then made whether or not to initiate reprogramming. The Service component commanders exercise this authority for their respective service.

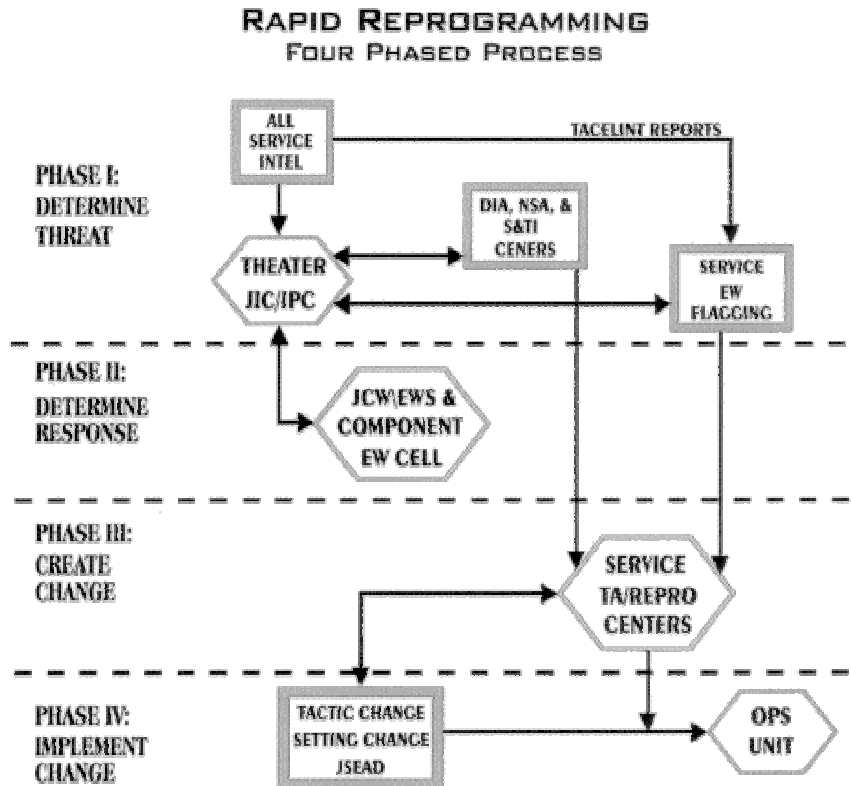
The third phase, creating the change, is solely a service responsibility. A change in tactics is usually the first option considered since software and hardware changes (reprogramming) take time. Often, a combination of changes (tactics and software) is prescribed. Commanders must verify the effectiveness of any type of change. This should be done on a test bench or a test range which simulates operational employment.

The last phase, change implementation, is also a service responsibility. This phase corrects the equipment deficiency. Tactics changes are incorporated into intelligence and mission briefs. Software changes are mechanically or electronically installed in equipment. Any hardware changes created by program managers, contractors or others, are installed in host platforms.

JCEWR was first exercised in ULCHI FOCUS LENS (UFL) 93. UFL93 included component EW/TSS equipment reprogramming as part of the service exercises SERENE BYTE 93/(USAF), BRAVE BYTE 93/(USA), and NEPTUNE BYTE 93/(USN). The EW reprogramming process was driven by Tactical Simulation Intelligence Model (TACSIM)/National Wargaming Systems (NWARS), Tactical Electronic Intelligence (TACELINT) reports and controller-injected events. Intelligence support and threat validation were provided by the IPC Joint Intelligence Center Pacific (JICPAC) and EW

reprogramming support was provided to the Component Commanders by the individual services as required.

The first JCEWR exercise provided an opportunity to evaluate JCEWR, joint service EW reprogramming, and provided excellent training to personnel in the field. Many strong points were identified as well as many deficiencies. Through the Joint Uniform Lessons Learned System (JULLS)



Program, Joint Command and Control Warfare Center (JC2WC), Defense Intelligence Agency (DIA) and service representatives made recommendations that will improve JCEWR and the EW reprogramming process. POCs are LCDR Tom Horgan, DSN: 969-3538/Mr. Sok Kim, DSN: 992-1337.

## JULLS: BETTERING THE FUTURE BY BUILDING ON THE PAST

### (Part 3 - Final In A Series)

"Nothing is permanent but change." Heraclitus

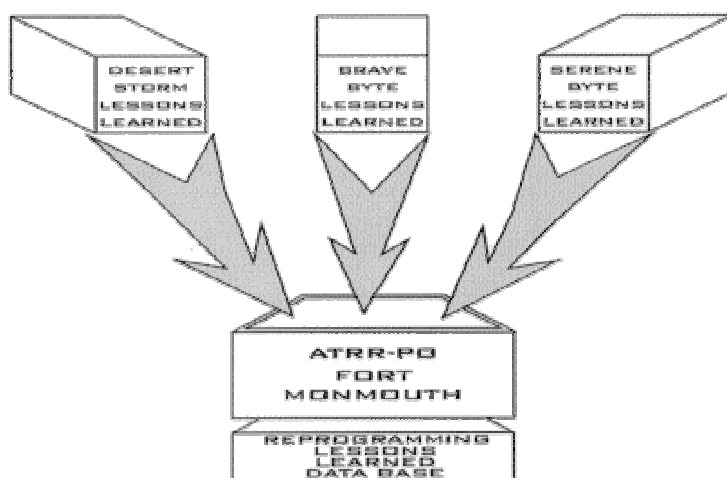
Part 2 of this series, (ARAT BULLETIN, October 1994), examined the mandatory section of a JULLS. Part 3 examines the Remedial Action Program (RAP) of a JULLS file, as well as the future of Army and reprogramming "lessons learned."

The RAP is used by the originators of lessons learned (the ARAT-PO for those issues which affect the Army Reprogramming Community) to assign action officers, develop milestones, and guide the resolution to problems identified within the lessons. The RAP section of the JULLS file has several key data entry fields. Users provide input to such fields as Action, Echelon, RAP Number, Lesson, Office of Primary Responsibility (OPR), and Validate In.

The Action field allows you to provide a "yes" or "no" answer to the question "Is there some formal action that will fix this problem?" The Echelon field indicates the level of the organization that will manage the action until it is closed. The RAP Number field contains a four digit code used to identify the RAP.

The Lesson field allows you to provide a "yes" or "no" answer to the question "Is there a lesson to be learned in this JULLS?" In this instance, a lesson is a work-around for a problem encountered, which the commander can use today. The OPR field indicates the office with primary responsibility for the action. The Validate In field includes the nickname and date of the exercise during which the solution to the problem will be evaluated. Other fields in addition to those above include: the date the action was solved, date the RAP was formally closed, POCs' recommendations for managing the action, funding required, and the date of the last OPR update.

You must turn to the ARAT Lessons Learned Data base to find what others have learned in past reprogramming exercises. This data base, resident at the ARAT-PO, Fort Monmouth, NJ, contains the lessons learned from previous BRAVE BYTE



**ARAT-PO MAINTAINS THE REPROGRAMMING LESSONS LEARNED DATABASE**

exercises. Reprogramming lessons learned from previous joint service exercises, as well as DESERT STORM, are also being incorporated into this data base. A listing of titles in the data base will be posted to the ARAT BBS and updated as new entries are received. Specific lessons learned can be obtained by contacting the ARAT-PO. If you are unable to utilize the BBS, contact the ARAT-PO to obtain a listing of the data base holdings. Several of the lessons learned are classified, so ensure you have secure facilities to view these lessons, especially in a computer environment.

The Army itself is progressing in the arena of lessons learned. The Army has developed the "Force XXI InfoNet," designed to provide a "management information environment for data integration that will be used to coordinate and integrate the result of analyses, lessons learned, and exercise or simulation results." This data base, managed by the Center for Army Lessons Learned (CALL) at Fort Leavenworth, KS, allows participation in the Army's lessons learned process and provides access to lessons learned not included in the JULLS master data base. The ARAT-PO recognizes the value of this initiative, and continues to coordinate for access to the "Force XXI InfoNet." Details on this coordination will be made available in later ARAT BULLETINS.

The future of the ARAT program depends upon your involvement. You can obtain a copy of the latest JULLS software (Version 5.0) by sending a memorandum through your chain of command to:

Operational Plans and Interoperability Directorate (J-7)  
Evaluation and Analysis Division  
The Joint Staff  
The Pentagon  
Washington, DC 20318-7000

Armed with the JULLS software, a keen eye for observation, and a desire to better the ARAT program's future, you can make a difference. As Information Operations becomes further ingrained into Army Doctrine, ARAT will be called upon to be a key contributor to this principle. You, as members of the ARAT community, will allow ARAT to answer this challenge and better the future by building on the past. POCs are Mr. Sok Kim/Mr. Joe Skarbowski, DSN: 992

# ARAT Site Connectivity: A WAN Approach

(First In A Series)

The Army Reprogramming Analysis Team (ARAT) was established, under the auspices of the Army (Target Sensing Systems) Rapid Reprogramming Project Office (ARAT-PO), as a networked infrastructure of activity centers which support the rapid reprogramming of Army Target Sensing Systems (ATSS). The activity centers currently include the ARAT Threat Assessment (ARAT-TA), two ARAT Software Engineering Centers (ARAT-SE), and two ARAT Support Cells (ARAT-SC).

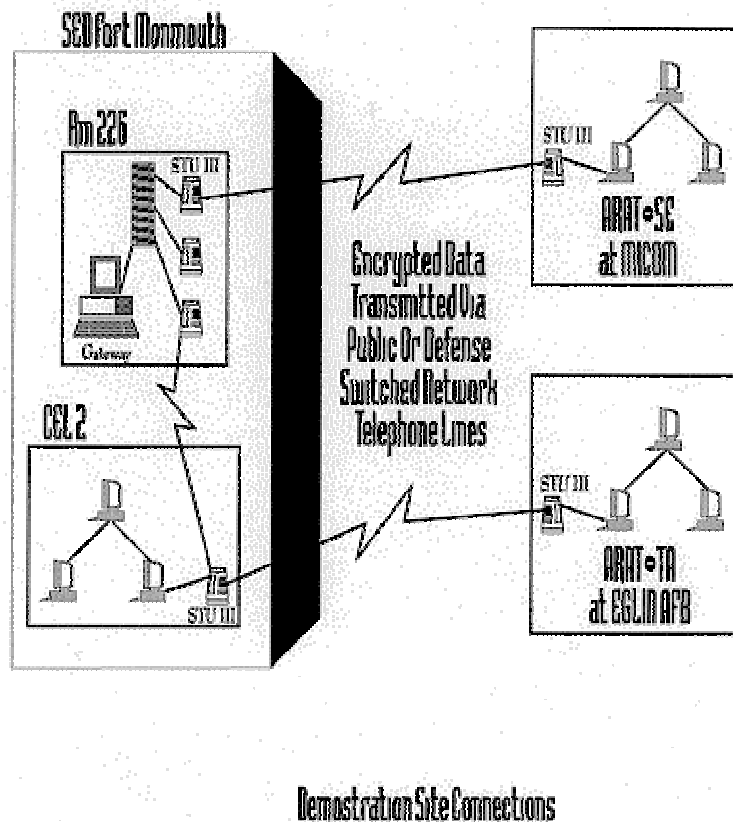
ARAT-PO is responsible for the overall coordination of ARAT operations, to include fielding hardware and software tools supporting ARAT operations. The purpose of the geographically dispersed ARAT centers is to cooperatively implement the functions necessary (i.e., analysis, impact assessment, software reprogramming, and distribution/ installation of the modified software to the fielded systems) to rapidly reprogram fielded ATSS in response to threat changes.

An important underlying requirement for ARAT success is that constituent team members/activity centers must have the capability to effectively and quickly exchange related information, such as signature data, analysis results, and associated correspondence. To assist this process, the Joint Services have developed specialized databases of Electronic Intelligence (ELINT) and Measurement And Signals Intelligence (MASINT) data, along with tools such as Computer-Aided Electronic Warfare Information System (CAEWIS) to analyze and manipulate the data. The ARAT infrastructure must provide an electronic data communications capability to support this information interchange and provide access to remotely distributed applications.

Selection criteria for a target ARAT data communications vehicle include: security (for handling classified data), responsiveness (to provide data communications on demand), interoperability (for cooperative interchange with other related Joint Service vehicles and services), reliability (to reduce possible service interruptions), standards (use of commonly used components and Department Of Defense (DOD) architectures), flexibility (to allow rapid expansion to other sites), and affordability (to minimize start-up and recurring costs).

Local area networks (LANs), comprised of commonly used Unix workstations, were implemented at the current ARAT sites to support inter-site data communications. Site to site connectivity must be established to fully implement the ARAT engineering infrastructure. Current methods used for the transfer of classified data between sites include General Services (GENSER) message, classified secure fax, and electronic bulletin board system (BBS). However, these methods do not completely satisfy the above mentioned selection criteria. Another method which more closely satisfies the selection criteria is to incorporate the ARAT site local area networks (LANs) into a wide area network (WAN).

A cost effective approach to implement a WAN is to access an existing WAN service. Access to a DOD-sanctioned service, such as the Defense Data Network (DDN), will provide greater assurance of interoperability with Joint Service activities. An effective strategy to implement an ARAT WAN would be to access the Defense Information System Network (DISN), which integrates existing DOD telecommunications resources under a DOD initiative to establish a global telecommunications infrastructure. Connecting to established DISN resources such as Defense Secure Network 1 (DSNET1) would not only provide for site-to-site connectivity, but also the necessary connectivity to fielded systems. By utilizing common components (transport media, network management, value-added services), a WAN solution that is effective, reliable, and expandable can be realized.



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## ARAT Site Connectivity (continued)

The ARAT-PO has developed an approach to implement a WAN to connect ARAT sites. Distribution to fielded systems is the subject for follow-on activity. After extensive analysis of ARAT information flow/data communications requirements, the target ARAT WAN architecture will be identified and documented. In parallel, concept exploration activities will be conducted to investigate, evaluate, and demonstrate various communications vehicles resulting in a series of demonstration WAN implementations. The target WAN will be implemented by upgrading the demonstration WAN.

WAN concept exploration is a multi-phased activity resulting in a series of connectivity demonstrations of secure data communications: 1) phone access with Secure Telephone Unit (STU) III encryption, 2) Military Network (MILNET) access with Network Encryption System (NES) encryption, and 3) Defense Secure Network I (DSNET1) access with KG-84 encryption. Presently, data communications between ARAT-PO and ARAT-TA sites have been successfully demonstrated via phone (STU III) and MILNET (NES) access.

Future WAN articles will address: WAN concept exploration, WAN services (to include low-level and value-added services), demonstration WAN support for Unified Endeavor 95; and efforts to gain ARAT access to DSNET1. POCs are Mr. Ken Kragh/Mr. Gary Conover, DSN: 992-6003.

*"To achieve victory, we must, as far as possible, make the enemy blind and deaf by sealing his eyes and ears, and drive his commanders to distraction by creating confusion in their minds."*

*Author Unknown*

Information Warfare (IW) and the U.S. Army's implementation strategy for Information Operations (IO) have applications during both war and operations other than war (OOTW). These are both offensive and defensive, encompassing counter-command and control (C2) and C2 protect functions.

Information warfare takes advantage of superior friendly information capabilities, while capitalizing on the opponent's vulnerable information dependencies. IW's strategic goal is to seize and maintain a decisive advantage by attacking an adversary's national information infrastructure through exploitation, denial, and influence, while protecting friendly information systems. Information warfare is implemented in the U.S. Armed Forces through national military strategy (NMS) by planning and executing Command and Control Warfare (C2W). The U.S. Army executes IW/C2W under authority of AR 525-20 (undergoing final coordination) and doctrinally through Information Operations (IO), to include: counter-C2, battlefield digitization, media activities, sensor-shooter connectivity, seamless C2, automation, C2 protection (Information Security [INFOSEC], Counter-Intelligence [CI] and survivability), and reconnaissance, surveillance, targeting and acquisition (RSTA) (Figure 1).

A great deal of discussion, concerning C2W and its role in fulfilling the national interests of IW, was initiated with the publication of Joint Chief of Staff (JCS) Memorandum of Policy (MOP) 30, C2W. IW is the Department of Defense (DOD) policy and National Security Strategy (NSS) as defined in DOD Directive TS 3600.1. Its principal intent is to make additional options available to the National Command Authority (NCA) prior to committing forces for war or OOTW against an adversary. The objective of IW is to attain a

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## LAND INFORMATION WARFARE ACTIVITY

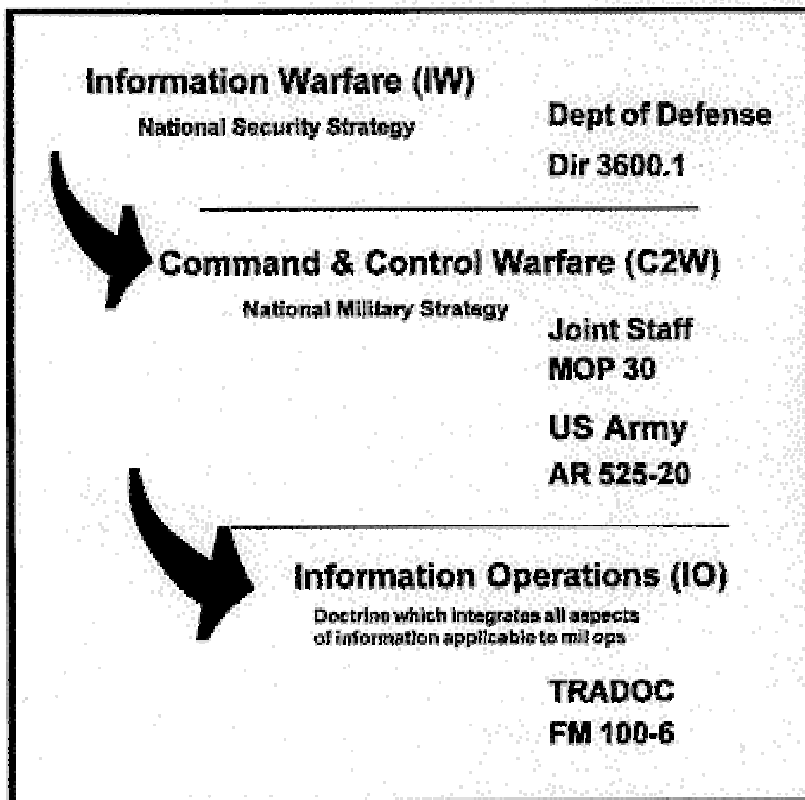


Figure 1

## Land Information Warfare (continued)

significant information advantage that results in situational domination and control of the adversary.

IW means something different to the many organizations and activities in the Army. Succinctly, information is critical to successful operations; weapons systems require discrete information; commanders require information noting adversary force disposition and intentions; communication equipment distributes information/data and require protection; and sophisticated collection systems gather information (Signals Intelligence [SIGINT], Measurements and Signals Intelligence [MASINT], Imagery Intelligence [IMINT], Photo Intelligence [PHOTINT], Counterintelligence [CI], etc.). Ultimately, the ability to acquire information about the adversary, and protecting that information becomes critical to military C2W operations planning and execution (Figure 2). The Army Reprogramming Analysis Team - Threat Analysis (ARAT-TA) and Land Information Warfare Activity (LIWA) will play an important role in determining discrete threat parameters, resolving ambiguity, and ensuring sophisticated weapons systems possess the correct target information. The LIWA will serve as the Army's focal point for providing IW support to Major Army Commands (MACOMs).

Information Warfare Continuum		
Military Operations	General US Goal	Examples
<div>COMBAT</div> <div>NONCOMBAT</div>	War	<b>Fight &amp; Win</b> Large Scale Operations Attack      Defend Blockades
	Operations Other Than War	<b>Deter War &amp; Resolve Conflict</b> Strikes      Raids Counterterrorism Show of Force Peacekeeping Counterinsurgency
		<b>Promote Peace</b> Disaster Relief Nation Assistance Counterdrug Civil Support Peacebuilding

Figure 2

On 29 September 1994, a Headquarters Department of the Army (HQDA) general officer steering committee asked Major General Scales, Director, Operations, Readiness and Mobilization to construct a memorandum of understanding (MOU) between the HQDA staff and Intelligence and Security Command (INSCOM) establishing the LIWA management functions and responsibilities. The MOU is currently in final staffing. The Deputy Chief of Staff, Operations (DCSOPS), Deputy Chief of Staff, Intelligence (DCSINT), Deputy Chief of Staff, Command, Control, Communications and Computers (DISC4), and INSCOM are the approval authorities and signatories. The

document is expected to be signed in mid-December 1994. Following this milestone, LIWA will be chartered and an official activation announcement will be made to DOD organizations. The LIWA is currently located at the INSCOM Headquarters, Fort Belvoir, VA. Colonel David M. Tanksley is the acting LIWA chief. The mission of the LIWA is to provide IW/C2W operational support to land component and separate Army commands, Active and Reserve Component (AC/RC), and to facilitate planning and execution of IO. The need for a LIWA-type organization emerged with the publication of JCS Memorandum of Policy (MOP) 30. This need was reinforced in the Training and Doctrine Command (TRADOC) IO operational concept for C2W implementation in the Army (see ARAT Bulletin, Volume 1, Issue # 3). The LIWA will help to strengthen coordination in joint operations and serve to leverage the expertise that exists within the DOD organization.

As the operational focal point for Land Information Warfare, the LIWA will coordinate planning activities with HQDA, Allied, Joint, Army Components, National Agencies, other service IW centers, Army MACOMs and their major subordinate commands (MSCs). LIWA arranges for, coordinates and synchronizes IW support to land component commanders for contingency planning and actual operations. The primary function of the LIWA will be to deploy field support teams (FSTs) to the land component headquarters to augment IW and C2W staff personnel. The FSTs will be composed of functional experts in the areas of deception, psychological operations (PSYOPS), electronic warfare (EW), operational security (OPSEC), and destruction. The FST approach minimizes force structure while providing C2W staff when and where required. FST members will exercise with supporting commands and join in the tough staffwork needed to plan and execute IW/C2W operations. Deconfliction of other ongoing C2W actions with Army component planning will be a forte of the FSTs.

The Army is beginning to grasp the enormity of the IW strategy by developing and defining strategic roles, in addition to its assigned roles at the operational and tactical levels.

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# **FROM THE ARAT BULLETIN STAFF:**

## **1994 - THE YEAR IN REVIEW**

Challenges, changes, and progress were abundant for Army reprogramming in 1994. The ARAT-PO and the ARAT-TA were no exceptions to these events.

Improvements to reprogramming information transfer highlighted ARAT-PO activities in 1994. The ARAT-PO continued efforts to identify a standardized memory loader verifier (MLV) for use in transferring software changes to the platforms which require software reprogramming. Additionally, the ARAT Bulletin Board System (BBS) came on-line in 1994, and now serves as a primary means of information transfer between ARAT sites and the Army reprogramming community in the field. The BBS was tested successfully during the reprogramming exercise BRAVE BYTE 94, another highlight of the past year. The initial stages of an ARAT Wide Area Network (WAN), which will ultimately serve as the primary data communications tool, were also implemented during the course of the year. Its capabilities were successfully demonstrated in December, and further efforts will continue in 1995.

The ARAT-PO began publication of the ARAT BULLETIN, a quarterly newsletter designed to provide timely, useful news and features to the Army's reprogramming community. The response to the BULLETIN has been extremely positive and now includes approximately 400 addressees. This number should continue to grow in 1995 as more organizations realize the value of this important information conduit.

Operational command and control of the ARAT-TA passed from Headquarters, Training and Doctrine Command (TRADOC) to the Intelligence and Security Command (INSCOM). This move placed the ARAT-TA under the auspices of the Land Information Warfare Activity (LIWA), and further integrated reprogramming threat analysis into the Army's Information Operations (IO) doctrine. The ARAT-TA continued to provide countless hours of quality threat analysis support to peacetime ATSS reprogramming efforts and crisis situations involving U.S. forces deployed throughout the world.

The above events are a mere sampling of what occurred in 1994. All of the past year's efforts have had significant, positive impacts on the future of Army reprogramming. As we head into 1995, we challenge the Army reprogramming community to continue striving to reach our goal of rapid software reprogramming support to the soldiers in the field.

## **THE STAFF**

## **Land Information Warfare (continued)**

Clearly, as stated by the Army Chief of Staff, "The 21 st Century is not waiting for the Army, it is already upon us", and we must meet the challenges in three ways. First, we must understand the information age battlefield. Second, we must modernize to take full advantage of information age technology. Third, and finally, we must continue to develop the programs which provide the power projection strategy. POCs are MAJ (P) Karen McManus, DSN: 235-2477 /Mr. Dan Hearn, DSN: 992- 1337.

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**"ARAT BULLETIN" will be published quarterly and is intended to provide the ARAT community with current information. You are invited to submit input for improving this publication, or present articles which will be of interest to our readers. You may fax correspondence to the Editor at (908) 532-5238. Include your name, telephone number, and source of information.**

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